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A Business Focus to Assessments

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Abstract

IT businesses today cannot survive without software process improvement. Efficient and cost-effective development processes are vital for being competitive. Before process improvement can be initiated a measure of the current set of processes needs to be established. An assessment is one approach to measuring processes to identify where to start the process improvement initiative. Assessments provide a disciplined examination of the software processes within an organisation. Assessments results show which processes are being performed and how well they are being performed. One of the enduring challenges in software process assessments is linking the assessment scope to an organisation's business focus. We present a rule based approach that can be used to identify some of the most relevant processes that ought to be assessed, leading to a more optimal scoping for an assessment given the company's business drivers. We describe how this has been integrated into an assessment method. Finally, we also present some advances in benchmarking the assessment results with practical examples. Benchmarking provides a way to learn from industries best practices and incorporate these practices into the organisation.

1. Introduction

To improve the software processes one needs to know which processes need improvement. One way to achieve this is to compare the organisation's current set of practices with a set of best practices derived from industry. This way, organisations learn what works best from other organisations and may then choose to adopt these practices themselves. An assessment is one approach to comparing organisational processes with industry best practices. They provide a disciplined examination of the processes within an organisation. An example of the best practices that can be used for assessment purposes is the international standards for software processes. However, all best practices in the standards may not be relevant for all organisations, as every organisation is different in what they produce or sell. Nevertheless, an assessment provides a profile of which processes that are being performed in an organisation and how well they are being performed. Assessments can also be used for marketing the organisation, determining the capability of a supplier organisation, providing feedback on how well the organisation is performing, and identifying risks related to processes within the organisation.

Although assessments are widely used within industry there are critical problems that still remain. Assessments are typically expensive and often not well connected with the organisations real problems and needs. A specific problem lies in selecting processes to assess, which may not be relevant to the business or the desired improvement. Using a fixed list or guessing the processes to assess are not good selection approaches. A structured way is required to select processes that are relevant to the business and is used in achieving the desired goals of the improvement program. If a process is not relevant then time and effort is wasted on assessing and improving a process that will have little or no impact on product quality or on the way the organisation develops the product. Therefore, it is important to select the right processes to assess.

In this paper we introduce an assessment method, called FAME (Fraunhofer IESE Assessment MEthod), that helps to systematically determine the best processes to improve by taking the business focus into consideration. The benefits of such an approach is that no time is wasted in assessing unnecessary processes and the improvement program is focused on the most relevant processes to improve.

2. Background

The assessment method presented in this paper, i.e. FAME, uses a common framework of best software engineering practices. The common framework used is ISO/IEC TR 15504 (also known as SPICE) [1] [2], the upcoming international standard for software process assessment. This framework can be used by organisations involved in planning, managing, monitoring, controlling, and improving the acquisition, supply, development, operation, evolution and support of software.

ISO/IEC TR 15504 has widely been recognised and used around the world. A number of established methods, like BOOTSTRAP [3] and CMMi [4], already use this framework. ISO/IEC TR 15504 has also been validated internationally in the SPICE trials [5] where it has proven useful for performing assessments. The

SPICE trials are the most extensive joint effort of Industry, the Public Sector, and Academia to collect and validate process assessment knowledge. Research into the SPICE trials is leading to a better understanding of how to improve assessments and provide better guidance towards process improvement. The results of this analysis, along with research at Fraunhofer IESE, are constantly being incorporated into the development of FAME.

Other research programs have also contributed to the development of FAME, like the PROFES project [6]. The PROFES project was set up within the European ESPRIT IV framework program to support technology transfer to industries that have strong product-related quality requirements, such as the embedded systems industry. The results from this project help defining explicit relationships between process and product. These results have been analysed and used in the FAME project to regard business needs when performing a focused assessment. A focused assessment is an assessment that only assesses selected processes and the capability of those processes. The greatest benefit in performing a focused assessment is that time is not wasted assessing irrelevant processes that will not impact the organisation. FAME scopes an assessment, to select only the most relevant processes, by using the techniques discussed in this paper.

3. The FAME Assessment Method

FAME is an advanced assessment method that contains features that address the problems faced by industry today in software process assessment. It is a stand-alone assessment method that is based on well-known assessment methods (i.e. SPICE and BOOTSTRAP) [2] [3], and uses the standard assessment model of the upcoming standard for software process assessment (ISO/IEC TR 15504) [1].

Using FAME has the following benefits:

- focuses on relevant business processes to guide process improvement efforts;
- provides a cost-efficient and reliable method to show a better return-on-investment for the improvement program;
- provides a tailorable approach for performing assessments;
- provides an approach that allows an organisation to compare its results with similar businesses that is based upon ISO/IEC TR 15504;
- provides a method that is applicable for small to large organisations.

FAME contains supplementary added value elements that have been developed through practical experiences from the worldwide SPICE trials and from Fraunhofer IESE research results. These added value elements are the Business Focus, Efficiency, Reliability, and Benchmarking.

3.1 The Added Value Elements of FAME

The added value elements were developed because of a strong need from industry to make assessments more cost effective and be more tightly coupled with a process improvement program. Each added value element and its relevance is discussed below:

Business Focus

If the organisation wants to develop an improvement plan from the assessment then the Business Focus element should be used with the FAME assessment. The goal of the Business Focus is to select the right processes for the right business. This allows the assessment to be focused and the most relevant processes to be targeted for the improvement program.

Efficiency

If the organisation is currently spending a lot of money performing an assessment or has little cost to spend on the assessment effort then the Efficiency element should be used with the FAME assessment. Efficiency looks at the factors you need to consider when performing a low cost assessment with maximum coverage of processes.

Reliability

If the organisation needs to benchmark or compare with other assessment results to show process improvement effort then the Reliability element should be used with the FAME assessment. Reliability looks at approaches and factors to consider for producing repeatable and accurate assessment results. This is very important for determining the right processes to improve. The desired level of reliability required can be determined based upon the needs of the organisation.

Benchmarking

After the FAME assessment, it can be a difficult to determine or justify which processes to improve. Benchmarking is one technique that shows you where to focus the improvement effort based upon the needs of the organisation. It allows an organisation to compare its processes with other projects or organisations to search for which best practices that leads to better performance. The Benchmarking element in FAME contains state-of-the-art techniques, such as OSR (Optimised Set Reduction) [7], for more versatile benchmarking.

3.2 Tailoring a FAME Assessment to the Business

FAME offers a tailorable approach in performing assessments. No one assessment approach can cover all possible situations. Each organisation will have different needs in performing the assessment and the method provides approaches for most organisational needs. Some of the reasons for performing a FAME assessment are:

- to define the process improvement program
- to use the results in marketing the organisation
- to determine the capability of a supplier organisation
- to provide feedback on how well the organisation is performing
- to identify risks related to software processes within the organisation

The FAME method is also flexible enough to be integrated into the selected improvement framework of an organisation. The method does not prescribe a particular approach to process improvement. Instead, there are many improvement approaches, such as QIP [8], GQM [9], or PROFES [13], to select from and use with FAME. FAME is used primarily to identify the software process strengths and weaknesses – the starting point for an improvement program.

FAME identifies a number of steps to be performed for different assessment needs. A number of different assessment types and added value elements are offered with FAME to provide flexibility to adapt to different assessment needs.

4. Focusing on Business Processes

It is obviously interesting for an Assessor to know which processes at least to assess (and potentially improve) if an organisational unit has certain goals in mind. Normally an Assessor makes these choices based on his/her expertise but our intention is to regard business focus more formally. At the moment, this is a developing research area, and there is not very much validated data available, but there are some promising techniques and ideas on how to proceed in practice.

There are two principal directions on how to select assessment purpose with direct business focus:

- **Process performance driven**
  These are goals such as Time-to-Market, Schedule or Productivity that are related to the performance (or outcome) of the processes.
- **Product quality driven**
  The reference model for the product quality driven goals is the ISO 9126 [10] standard that defines six product quality characteristics (Reliability, Maintainability, Portability, Usability, Functionality and Efficiency).

Using explicit product quality goals or performance goals existing dependencies are retrieved to show a set of candidate processes for selection. The most suitable processes are then selected for a focused assessment, depending on the assessment context. In this way the organisations business goals are considered explicitly, and assessment contains only those processes that are important for achieving the business goals. We use the following approaches in FAME assessments to determine the relevant processes to select from the product or performance goals:

- **Product-Process Dependency (PPD) Modelling**
  Based on product quality goals, the related processes are identified using a PPD repository.
- **Study on Influential Processes**
  The related processes are selected based upon the desired performance goals that have been derived from the SPICE trials.
- **Experience based Heuristics**
  Simple heuristics are used to select the most relevant processes based on a collection of Assessor experiences between the processes improved and the resulting performance.

We consider all three approaches described above useful in scoping an assessment by selecting the right processes to assess. Each approach has certain advantage over the others described. They mainly differ in the type of business focus offered and the bases in deriving such results. The PPD modelling work and the Influential processes study are based on empirical research, and the Heuristics approach is based on Assessor experience. However, when using any of the above approaches, the Assessor must take care in using the results. They must take into consideration the following factors:

1. The results are conservative which means that there may be other processes that are associated with a product/performance measure.
2. It is not stipulated that an organisation must assess and improve all resulting processes identified in order to improve a corresponding product/performance measure.
3. The first two approaches include statistical evidence that should not be taken as absolute truth. However, interpreting these results may provide additional insight when planning assessments.

In this paper, we look at each of the approaches, described above, for selecting processes that have a direct impact on the business being assessed.

5. Product-Process Dependency Modelling

A number of studies have shown that the quality of a software product is directly dependent on the quality of the processes that produced it [13] [11]. However, in terms of process improvement, organisations do not think, or actually know, the processes to improve in order to build a better product. They only think in terms of product goals and what they would like to achieve from it. A technique is required to establish a link between product quality and process. Such a link would identify the most relevant business processes to assess and improve upon.

5.1 Background of Study

The Product-Process Dependency (PPD) modelling is a line of research in the PROFES project [6] where techniques for establishing links between product quality and processes have been developed. The approach has been trialed in three industrial companies within the PROFES project, and the results look very promising. There is also a web-based repository of Product-Process Dependencies, where currently over 300 PPDs are defined. The repository can be found at: http://www.profes.org/. More information on PPDs can be found in [11].

5.2 Using PPDs in Assessments

Based on product quality goals, the related processes are identified using the PPD repository. Using explicit product quality goals existing Product-Process Dependencies are retrieved to show a set of candidate processes for selection. The most suitable processes are then selected for focused assessment depending on the assessment context. In this way the product quality goals are considered explicitly, and assessment contains only those processes that are important for achieving the product quality goals. An example of the approach is shown in Figure 1.

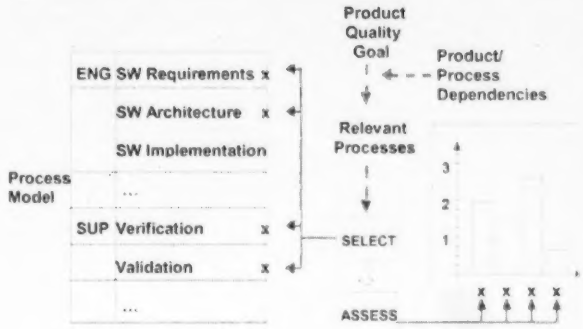

Figure 1. Product focus in assessments

In the Figure 1, the product quality goal affects the assessment. A product/process dependency repository is used to find candidates for assessment. These are processes that have a high potential for influencing a particular product quality goal. For example, the Validation process may be important when trying to achieve high reliability. Based on the candidate processes, a selection of processes is chosen to be assessed.

6. The Study on Influential Processes

The basic underlining belief behind all assessments is that there is a direct link between capability of software processes to the performance of the organisation or project [12]. For example, it is very difficult to deliver software on time without good software processes in place. Of course, this belief must also take into consideration certain context factors that may influence the performance outcome. The team size, the product domain, and cultural differences are just a few examples of the many influences there are on the performance. This influence on performance outcomes can be shown in Figure 2.

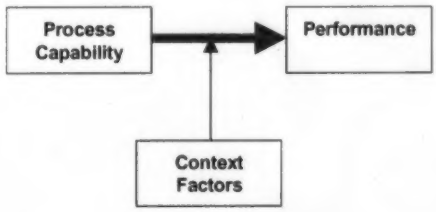

Figure 2. Influential Processes Model

6.1 Background of Study

This is a study made in the context of SPICE phase II trials [14]. The main hypothesis of the study is that some processes have greater impact on actual performance than others. Currently, only four processes in the Engineering category, defined in ISO/IEC 15504 [1], have been studied. They are:

- Develop Software Requirements (ENG.2)
- Develop Software Design (ENG.3)
- Implement Software Design (ENG.4), and
- Integrate and Test Software (ENG.5).

The preliminary results of this study have been summarised in Table 1. In the first column are the performance measures that were collected for each project. In the second column are the development processes whose capability was evaluated. The results are presented separately for small (equal to or less that 50 IT staff) and large organisations (more than 50 IT staff).

These preliminary results can be used as guidance for assessment and improvement planning. The study will be extended and continued in the SPICE Phase III trials.

Table 1. Processes related to performance goals

Performance Measure	Process(es)
Small Organisations	
Ability to meet budget commitments	
Ability to meet schedule commitments	Develop Software Design (ENG.3)
Ability to achieve customer satisfaction	
Ability to satisfy specified requirements	
Staff productivity	
Staff morale / job satisfaction	
Large Organisations	
Ability to meet budget commitments	Develop Software Design (ENG.3) Implement Software Design (ENG.4)
Ability to meet schedule commitments	Develop Software Design (ENG.3)
Ability to achieve customer satisfaction	Develop Software Design (ENG.3)
Ability to satisfy specified requirements	Develop Software Design (ENG.3)
Staff productivity	Develop Software Requirements (ENG.2) Integrate and Test Software (ENG.5)
Staff morale / job satisfaction	Develop Software Design (ENG.3)

6.2 Using Influential Processes in Assessments

The results of the study discussed above can be used to scope an assessment according to the business objectives of an organisation. For example, let's say an organisation identifies productivity as an important business objective, and it has 90 IT staff. Then, according to Table 1 the two processes that ought to be considered for inclusion within the scope of the assessment are Develop Software Requirements (ENG.2) and Integrate and Test Software (ENG.5).

7. Experience Based Heuristics

Experts in assessments, like software engineering, develop their own set of heuristics while working in their field of expertise. These heuristics are usually not explicit but often are useful for others. Capturing and using these heuristics can be a useful aid in learning from past experiences.

7.1 Background of Study

Fraunhofer IESE has collected some experience-based heuristics to be used to support FAME assessment planning, especially for novice Assessors. The heuristics collected are simple cause-effect relationship between business objectives and software processes. Table 2 illustrates some examples of the types of heuristics captured. These heuristics are collected together in an experience-base database of assessment knowledge. However, until enough data is collected then this field of study will remain of limited use. Fraunhofer IESE wishes to collect more of these types of heuristics to build up the experience-base further.

Table 2. Heuristics relationship on software processes

Business Objective	Software Process
Improve Product Quality	Requirements Management Testing Quality Management
Customer Satisfaction	Requirements Management Project Management Customer Support
Reduce Time-To-Market	Customer Needs Management Project Management Risk Management
Reduce Costs	Project Management Requirements Management

7.2 Using Experience Based Heuristics in Assessments

The information presented in Table 2 is most likely intuitive to an experienced Assessor, but this is not the case for a novice Assessor. Most novice Assessors are looking for such guidance in selecting processes based on past Assessor experience. For example, the Assessor could deduce from Table 2 that Customer Support, Project Management, and Requirements Management, are important processes to assess for an organisation that wants to focus on customer satisfaction.

9. Learning from Best Practices

Benchmarking is a positive, proactive process to change operations in a structured fashion to achieve superior performance [15]. The benefits of using benchmarking are that functions are forced to investigate external industry best practices and incorporate those practices into their operations. This leads to profitable, high-asset utilisation businesses that meet customer needs and have a competitive advantage.

Benchmarking has been used in assessments to build better models of comparison between product/performance goals and processes. In order to benchmark, a large set of data is required to analyse for such comparisons. The SPICE Trials contains a large set of information that is useful for showing such a comparison. Benchmarking results can also be generated to show a linkage between the businesses goals and processes. The SPICE Trials collects a number of performance goals, context factors, and assessment results from each assessment performed. The SPICE Trials are currently in the last phase and they intend to collect over 3000 assessments worldwide. This type of data will be useful for benchmarking against to better enhance the study on influential processes (see Section 6), as well as the PPD repository (see Section 5).

Fraunhofer IESE plays a major role in the SPICE Trials in developing benchmark results to participants of the Trials. They use state-of-the-art techniques to build benchmark results. Such techniques are even able to handle missing data records that may be important to generate results. Fraunhofer IESE has incorporated the techniques into a tool, called Optimised Set Reduction (OSR) to provide benchmark results for SPICE Trials participants. The tool uses traditional machine-learning techniques in an algorithm [7] that is able to generate a set of patterns relevant to the industry to be predicted. In the SPICE trials, benchmarking is performed against each process assessed, so the result is a benchmark profile. The benchmark profile will allow participants of the trials to determine where they are positioned in their industry with processes. The information presented is aggregated to ensure confidentiality of all data in the international SPICE Trials database.

Other sets of analysis will be performed in the SPICE Trials using benchmarking techniques. The aim is better learn which techniques provide industry with the most informative information on best practices. The result will mean industry are better informed on which processes should be assessed to position themselves within their market. Fraunhofer IESE is also performing internal benchmarking within companies who only wish to learn from best practices within. Internal benchmarking is used to find out how a project compares to other projects in the company (past or current). It is also useful for evaluating the risks in taking up new projects by comparing to previous performance. Benchmarking in general can be performed externally or internally, with the greatest benefits in performing both types. External benchmarking, like the SPICE Trials, is used to find out how an organisation compares to other similar organisations in the industry. It is also used by large acquires of software systems to gauge the relative performance of their suppliers.

10. Conclusions

This paper has presented a number of approaches that can be used to scope an assessment to regard the needs of the business. The approaches presented are product/process dependencies, influential processes, and experience based heuristics. All approaches have a different focus on what the business will need (i.e. either product or performance driven goals). Guided by these approaches the assessment team is likely to lead an efficient assessment with strong emphasis on processes that need to be improved from the business perspective. Naturally, some caution must be used with all of these approaches because they do not guarantee that improving the selected processes will fulfil the product or performance goal. These approaches are no more than a guide for the Assessor on how to scope an assessment. However, we believe that they provide a useful addition for the assessment knowledge in the software process community.

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